Chapter VIII – Conclusion

The 23 policy options presented above offer a wide range of benefits to the state of Utah including energy savings, economic benefits, water savings, and reduced pollutant emissions. In total, the options provide primary energy savings of 127.6 trillion Btus (16.7 percent) by 2015 and an estimated net economic benefit of $7.3 billion over the lifetime of efficiency measures installed during 2006-2015. Below we summarize those benefits and review our recommended high priority policies.

Energy Savings

Table 31 shows the electricity savings in 2010, 2015, and 2020, by option. These options were analyzed in a manner that attempted to avoid double counting of energy savings, so the savings are additive. The options that offer the largest savings potential in 2015 and 2020 are expanded electricity DSM programs and lamp and appliance efficiency standards. The total electricity savings potential in 2015 is 6,189 GWh per year, which represents an 18.1 percent reduction from projected baseline electricity consumption that year. Thus the electricity saving options are adequate to meet the 20 percent efficiency improvement goal for electricity, which means at least a 16.7 percent reduction in electricity use in 2015 from the otherwise forecast level. Note that no electricity savings are assumed for the CHP option since it leads to a shift in electricity generation from central station power plants to on-site generation, not electricity savings per se.

The electricity savings potential continues to grow significantly after 2015, reaching over 10,300 GWh per year by 2020. This savings potential represents about 25.7 percent of projected electricity demand for that year, in the absence of the efficiency initiatives. In addition to the substantial electricity savings, implementing the options listed in Table 31 would also greatly reduce peak power demand. RMP's DSM programs in particular emphasize air conditioning efficiency and load control, meaning a larger reduction in peak demand in percentage terms relative to the reduction in electricity use. Building code upgrades and better code enforcement should have a similar impact.

Table 31 – Total Electricity Savings Potential

	Savings Potential (GWh/yr)		
Option	**2010**	**2015**	**2020**
Electricity DSM expansion	894	2,375	4,108
Building code upgrades	214	674	1,391
Appliance standards	137	1,334	2,137
Industrial challenge	130	615	1,183
Public sector initiatives	169	421	604
Public education	226	393	420
Other	202	377	476
TOTAL	**1,972**	**6,189**	**10,319**

Figure 3 shows the growth in electricity use during 2005-2020 in the baseline and high-efficiency scenarios; i.e., assuming implementation of all electricity savings options. In the baseline scenario, electricity demand grows 3.2 percent per year on average, based on RMP's most recent electricity demand forecast and with the effects of planned DSM programs removed. In the high-efficiency scenario, electricity demand growth is limited to 1.2 percent per year on average during 2005-2020. Thus, implementing all of the electricity savings options would not entirely eliminate load growth, but it would reduce it by over 60 percent.

Figure 3 – Electricity Consumption by Scenario

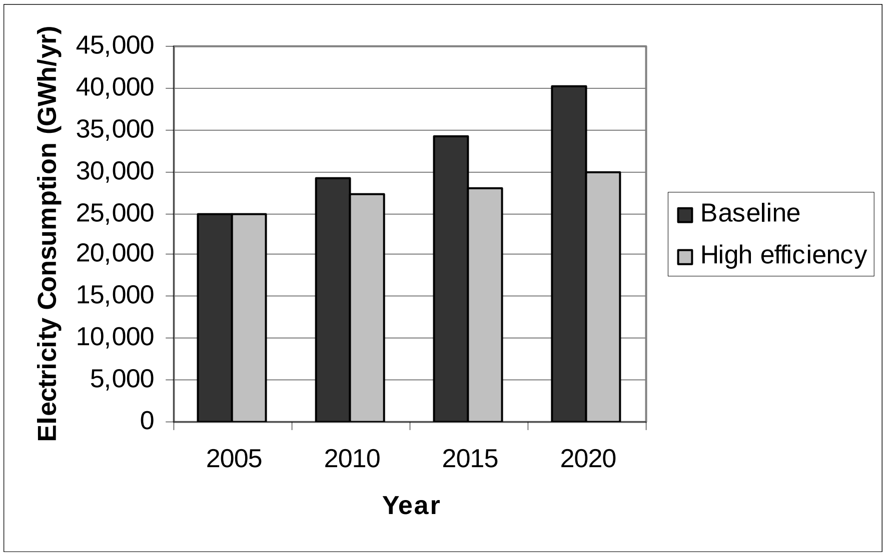


Table 32 shows the natural gas savings by option. These options were also analyzed to avoid double counting of savings, so the savings are additive. The options that offer the largest gas savings potential include gas utility DSM programs, building energy codes, and the industrial challenge and recognition option. The total gas savings potential in 2015 is about 22.2 million decatherms per year. This represents 14 percent of projected baseline gas consumption for that year, in the absence of energy efficiency initiatives. Thus, the natural gas saving options are not adequate to meet the 20 percent efficiency improvement goal for natural gas, interpreted to mean at least a 16.7 percent reduction in gas use in 2015 from the otherwise forecast level.

The gas savings potential continues to grow significantly after 2015, reaching nearly 38 million decatherms per year by 2020. This savings potential represents over 22.3 percent of projected natural gas demand for that year, in the absence of the efficiency initiatives. The gas savings potential is limited in part by the fact that natural gas use has declined somewhat in recent years due to high gas prices and other factors, meaning that significant efficiency improvements have already occurred.

Table 32 – Total Natural Gas Savings Potential

Option	Savings Potential (million decatherms per year)		
	2010	**2015**	**2020**
Gas DSM expansion	2.33	8.27	14.94
Building code upgrades	1.25	3.74	7.48
Conservation ordinances	0.40	1.20	1.60
Low-income weatherization	0.48	1.28	1.84
Industrial challenge	0.78	3.71	7.25
Public sector initiatives	0.86	2.10	2.96
Public education	1.09	1.75	1.69
Other	0.04	0.14	0.21
TOTAL	**7.23**	**22.19**	**37.97**

Figure 4 shows the growth in natural gas use during 2005-2020 in the baseline and high-efficiency scenarios; i.e., assuming implementation of all natural gas savings options. The scenarios do not include natural gas use for electricity generation in the electric utility sector. In the baseline scenario, natural gas consumption increases 1.5 percent per year on average, based on QGC's most recent forecast and an estimate of industrial natural gas demand growth. In the high-efficiency scenario, gas demand increases slightly in the early years but then declines in absolute terms. By 2020, total natural gas consumption is slightly below that in 2005. Thus, we estimate that the energy efficiency options are adequate to eliminate growth in natural gas consumption over the medium-term in Utah.

Figure 4 – Natural Gas Consumption by Scenario

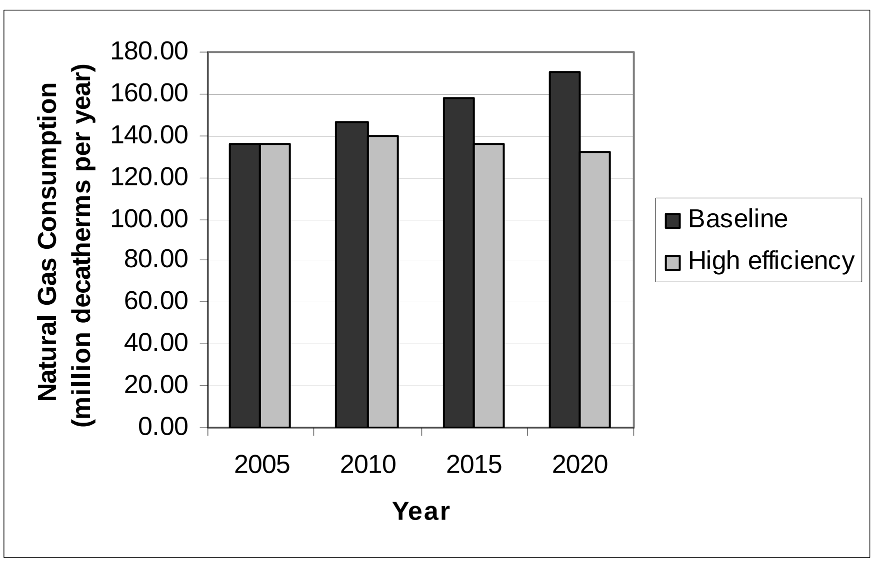


Table 33 shows the potential savings of gasoline and diesel fuel. In Chapter VI, each transportation option is analyzed independent of the other options. However, adjustments are made here to consider the gasoline and diesel savings options in combination and avoid double counting of energy savings; e.g., the savings from vehicle efficiency improvements is reduced if VMT is being reduced at the same time, and vice versa. The options that offer the largest potential gasoline savings are the clean car standards and pay-as-you-drive insurance. The total fuel savings potential is estimated to be about 6.7 million barrels of fuel per year in 2015. The gasoline savings from the measures in combination represents 18.3 percent of projected gasoline consumption for that year, in the absence of energy efficiency efforts. Thus, the gasoline savings options in combination meet the 20 percent efficiency improvement goal. However, the diesel fuel savings in 2015 represent only about 9 percent of projected diesel fuel use for that year, in the absence of new efficiency initiatives. Thus, the diesel fuel option is not adequate to meet the 20 percent efficiency improvement goal by 2015.

The gasoline and diesel fuel savings continue to grow significantly after 2015, reaching about 11.8 million barrels per year in 2020. This savings potential represents over 30 percent of projected gasoline demand and over 11 percent of projected diesel fuel demand for that year, in the absence of the efficiency initiatives. These energy savings values are conservative in that they do not include the upstream savings in petroleum refining and transport.

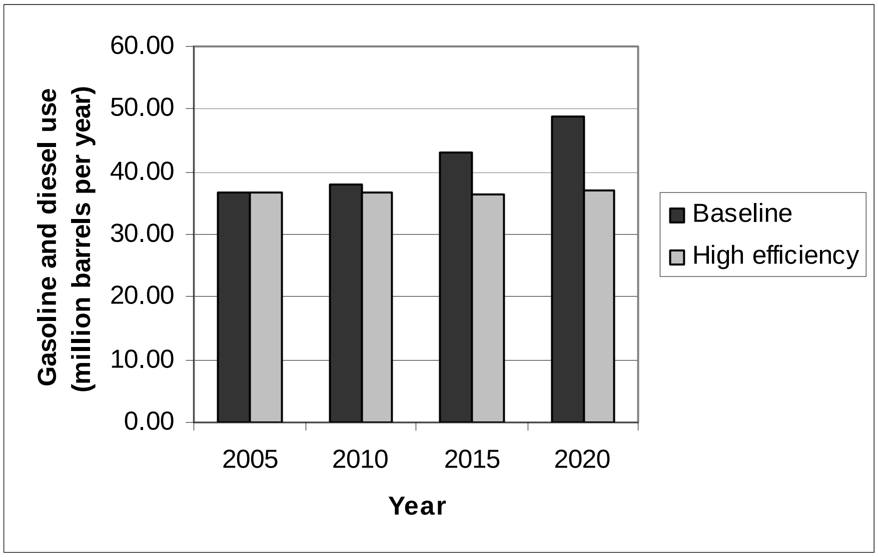
Table 33 – Total Gasoline and Diesel Savings Potential

	Savings Potential (million barrels per year)		
Option	**2010**	**2015**	**2020**
Clean car standards	0.238	2.076	4.586
Feebates	0.164	0.984	1.784
PAYD insurance	0.030	1.503	3.299
Reduce VMT growth	0.110	0.714	1.423
Enforce speed limits	0.621	0.702	0.796
Truck efficiency measures	0.248	0.992	1.439
Replacement tire standards	0.205	0.676	0.742
TOTAL[1]	**1.518**	**6.718**	**11.803**

[1] The totals do not equal the sum of the values in the columns in order to take into account the interactive effects of the options.

Figure 5 shows the growth in gasoline and diesel fuel use during 2005-2020 in the baseline and high efficiency scenarios; i.e., assuming implementation of all of the transportation options. In the baseline scenario, demand for these fuels increases close to two percent per year on average given expected growth in driving and assumptions about vehicle efficiency. In the high-efficiency scenario, demand for these transportation fuels increases only about 0.3 percent per year on average during 2005-2020. Gasoline consumption actually falls but diesel fuel use still rises during this time period.

Figure 5 – Gasoline and Diesel Fuel Use by Scenario



We also examine the overall energy savings from all fuels and options combined by converting fuels and electricity to primary energy units. In doing so, we account for energy losses in electricity production and delivery using the average efficiency of power plants and average transmission and distribution losses in Utah. Natural gas and liquid fuels are converted to primary energy based on their direct energy content only. Table 34 shows the resulting primary energy consumption for the baseline and high-efficiency scenarios. The values cover only those fuel types considered in this study; i.e., we do not include other forms of energy such as jet fuel or coal directly consumed by industry. The primary energy savings shown in Table 34 includes the savings from the CHP option.

Table 34 – Primary Energy Savings Potential

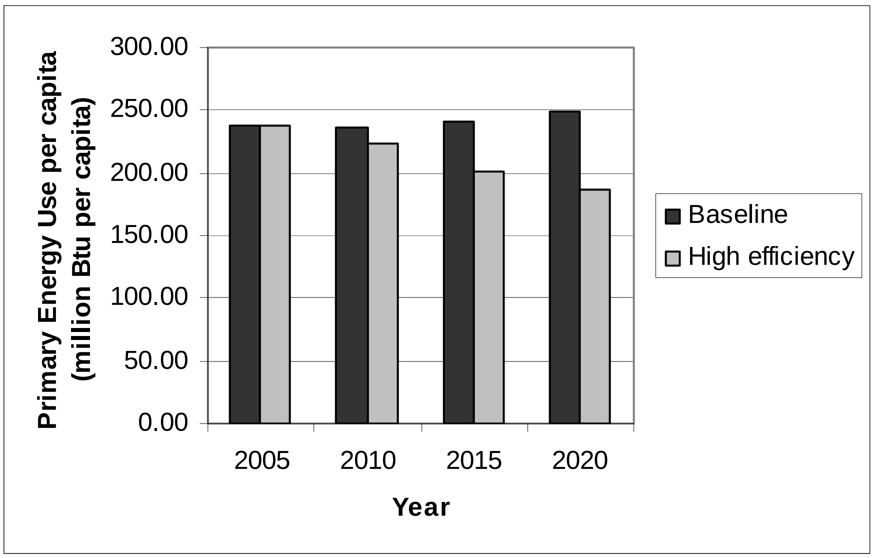
	Primary Energy Consumption or Savings (trillion Btu per year)			
	2005	**2010**	**2015**	**2020**
Baseline Scenario	598.5	669.3	762.0	868.7
High Efficiency Scenario	598.5	631.4	634.0	651.3
Energy use per capita – Baseline Scenario [1]	237.8	236.3	241.1	249.2
Energy use per capita – High Efficiency Scenario [1]	237.8	222.9	200.6	186.8
Savings in High Efficiency Scenario	0.0	37.9	128.0	217.4
Savings as percent of baseline energy use	0.0	5.7	16.8	25.0

[1] The unit is million Btu per capita.

Table 34 shows that the options reduce primary energy use by 128 trillion Btus (16.8 percent) by 2015. This is slightly more than is necessary to meet the 20 percent energy efficiency improvement target that year. The savings continue to increase rapidly after 2015 as the buildings, appliance, and vehicle stock continues to turnover, reaching over 217 trillion Btus of savings in 2020. This is equivalent to about 25 percent of baseline primary energy use by 2020.

Figure 6 shows projected primary energy per capita over time in each scenario. In the baseline scenario, energy use per capita is projected to increase slightly during 2005-2020. But energy use per capita is projected to decrease over 21 percent between 2005 and 2020 in the high-efficiency scenario.

Figure 6 – Energy Use per Capita by Scenario

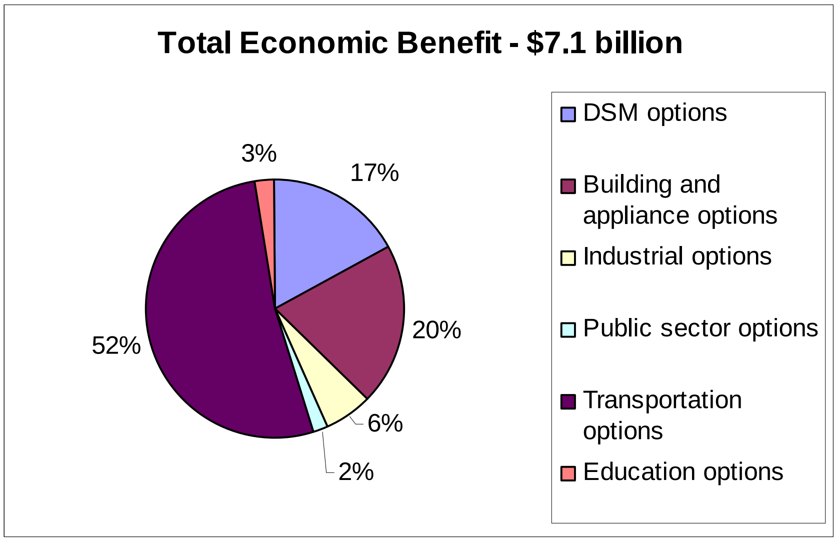


Economic Costs and Benefits

Figure 7 shows the estimated net economic benefits of the options where net economic benefits have been quantified. The net economic benefits are the net present value of benefits minus costs for efficiency measures installed during 2006-2015, considering the energy savings over the lifetime of measures installed during this period and using a five percent discount rate to discount future costs and benefits. The options are clustered by area, and in the transportation area are adjusted compared to those reported above in order to avoid double counting and the overestimating of benefits when options are implemented in combination.

In total, the estimated net economic benefits are about $7.1 billion. This is equivalent to saving about $6,700 per household on average, considering the projected number of households in Utah as of 2015.[201] Approximately 52 percent of the benefits result from the transportation options, 20 percent from the building and appliance options, 17 percent from the DSM options, and 11 percent from the remaining options. We believe these estimates are conservative because energy prices are not assumed to rise above inflation. In reality the cost of both fuels and electricity is likely to rise faster than inflation due to supply constraints, rising construction costs, and other factors. Also, we do not include valuation of non-energy benefits, which in some cases could be substantial.

Figure 7 – Net Economic Benefit of Energy Efficiency Options



It should be noted that economic benefits have not been quantified for a few of the options, although these are expected to be minor and largely covered by the options where energy savings and economic benefits have been quantified. In addition, further economic benefits will result from efficiency measures adopted after 2015 assuming the policies and programs remain in effect.

Regarding the potential costs and benefits to Utah's state government, upgrading energy efficiency in state buildings and facilities (Option 12) is the most costly but also results in a significant net economic benefit. With an investment of about $14 million per year in efficiency measures in state facilities, we estimate net economic benefits of $88 million over the lifetime of efficiency measures implemented during 2007-2015, on a net present value basis. This is more than adequate for offsetting the cost to state government of all the other options combined. These costs to the state are estimated to equal about $9 million per year on average during 2008-2015. The largest item, representing nearly half the total, is the additional state contribution to low-income home weatherization. Other significant provisions include tax credits for highly-efficient buildings and appliances,

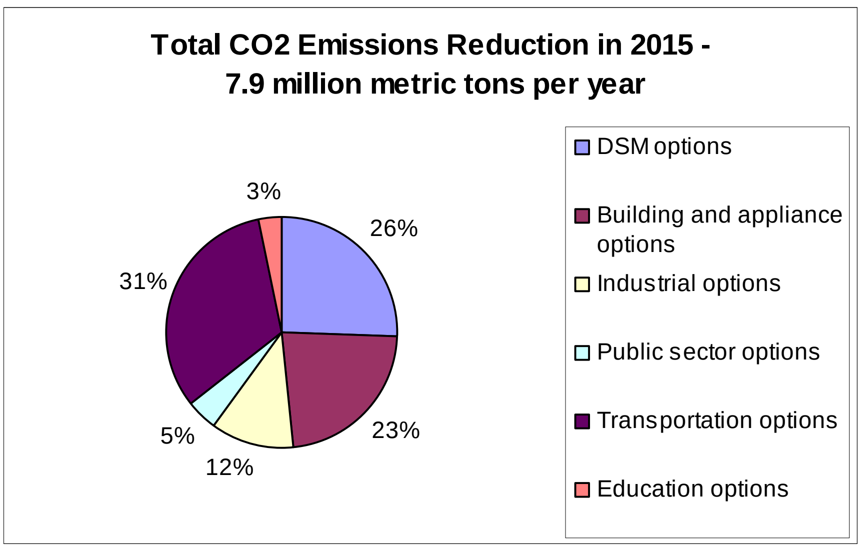
[201] The projected number of households in 2015 is 1.06 million according to the Governor's Office of Planning and Budget, 2005 Baseline Projections. The savings per household includes savings realized by businesses.

pay-as-you-drive insurance subsidies, the public education campaign, and energy efficiency training and certification efforts.

Environmental Benefits

Implementing the energy efficiency options would provide substantial environmental benefits within and beyond the state of Utah. Carbon dioxide (CO_2) emissions, the main pollutant contributing to global warming, would be reduced as a result of decreased fossil fuel consumption for power generation, vehicle operation, space heating, and other purposes. Figure 8 shows the estimated CO_2 emissions reductions in 2015 by option cluster. Of the total of 7.9 million metric tons of avoided CO_2 emissions that year, transportation options provide about 31 percent, DSM options about 26 percent, and building and appliance options about 23 percent. The estimated CO_2 emissions reduction grows to about 14.0 million metric tons per year by 2020.

Figure 8 – Carbon Dioxide Emissions Reductions in 2015 from Implementation of the Energy Efficiency Options



There also will be significant water savings, particularly from options that result in reduced operation of fossil-fuel based power plants because these plants consume sizable amounts of water in their cooling systems. We estimate that the options taken together will lower water consumption in power plants by approximately 3.4 billion gallons per year in 2015 and 5.6 billion gallons per year in 2020. The latter is equivalent to the annual water use of 36,600 average Salt Lake City households.[202] Furthermore, there will be additional water savings from promotion and increased adoption of energy and water-conserving devices such as resource-efficient clothes washers and dishwashers.

[202] Residential water consumption in Salt Lake City averages about 140 gallons per day per capita, or 153,000 gallons per year. See *Water Conservation Master Plan 2004*. Salt Lake City Department of Public Utilities. Salt Lake City, UT.

Priority

Among the 23 options developed in this report, we suggest that 11 be viewed as high priority by the Governor, the Legislature, the Public Service Commission, and other key decision makers. These options provide the greatest energy savings and consequently the bulk of the economic and environmental benefits. The following list presents our suggested high priority options:

- Energy Savings Standards or Targets for Electric Utility Demand-Side Management Programs
- Expanded Natural Gas Utility Energy Efficiency Programs and Energy Savings Targets for These Programs
- Upgraded Building Energy Codes and Funding for Code Training and Enforcement
- Lamp and Appliance Efficiency Standards for Products Not Covered by Federal Standards
- Expand Low-Income Home Weatherization
- Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions
- Energy Savings Targets for State Agencies
- Clean Car Standards for New Cars and Light Trucks
- Pay-As-You-Drive Auto Insurance
- Reduce the Rate of Growth in Vehicle-Miles Traveled
- Broad-Based Public Education Campaign

In conclusion, Utah would save a large amount of energy if it adopted the high priority energy efficiency policy options, and possibly other options, described and analyzed in this study. By 2015, electricity use could be reduced by 18 percent, natural gas use by nearly 14 percent, and gasoline use by 18 percent, all in comparison to otherwise forecasted levels of energy use that year. By implementing all of the options, the ambitious energy efficiency goal set by Governor Huntsman could be achieved, at least for the forms of energy considered in this study. Furthermore, the energy savings would continue to grow rapidly during 2016-2020, reaching 25 percent primary energy savings by 2020.

Substantial benefits would result from achieving these levels of energy savings. Consumers and businesses in Utah could save over $7 billion net during the lifetime of efficiency measures implemented through 2015. Water savings would reach 3.4 billion gallons per year by 2015 and about 5.6 billion gallons per year by 2020. Pollutant emissions would be cut as well. Most notably, Utah would significantly reduce its carbon dioxide emissions, thereby contributing to the worldwide effort to limit global warming, and would do so very cost effectively. Local air quality would also improve. Aggressively pursuing greater energy efficiency is truly a winning opportunity for Utah's citizens, businesses, government, and environment.